NEW ENGLAND DISTRICT MITIGATION GUIDANCE

for NEW ENGLAND DISTRICT MITIGATION PLAN CHECKLIST

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INTRODUCTION

Applicants should contact the Corps prior to initiation of site selection and mitigation plan development because mitigation requirements are project-specific. This New England District document and the associated New England District Mitigation Plan Checklist ("Checklist") are for use when the Corps determines mitigation is appropriate for a particular project. They represent New England District policy and have already incorporated the requirements of the following documents:

1. Model Compensatory Mitigation Plan Checklist and supporting supplement (http://www.mitigationactionplan.gov/checklist.pdf), and
2. Incorporating the National Research Council's Mitigation Guidelines into the Clean Water Act Section 404 Program. (http://www.mitigationactionplan.gov/nas404program.pdf)

In addition, federal agencies involved with mitigation are developing guidance on many aspects of mitigation. The status of the Mitigation Action Plan components, and the guidance documents themselves as they are completed, is available at **http://www.mitigationactionplan.gov/**.

The purpose of this document is twofold:

1. To provide guidance to the regulated community on the requirements for mitigation required by the Corps of Engineers, New England District, and
2. To provide a standardized format for the Corps to use in reviewing mitigation plans for their technical merit.

It is important to note that there is some flexibility in the document. For example, it is not designed to be specific to tidal wetland creations and would therefore need to be modified for such situations. When variances are necessary, the proposed mitigation plan should provide a simple explanation of the rationale. However, some items are required by law or policy and are indicated by use of the term "must." We acknowledge that absolutes are rare in mitigation design and that a successful site requires careful design, detailed review, and common sense oversight during construction by a person well versed in wetland science.

All checklist items should be included in the mitigation plan or there should be an explanation as to why it is not appropriate.

After Corps review, items <u>not</u> marked with OK, N/A (Not Applicable), or NONE should be addressed by the applicant. A sample table to cross-reference the checklist and a mitigation plan is included as Table 1.

Occasionally there are conflicts between requirements of the Corps and those of state and/or local agencies. Notify the Corps when this situation arises and the Corps will work with the applicant and state or local agencies to avoid duplication of effort and meet agency requirements. Normally, use of the most rigorous standard will be acceptable to all agencies. The Corps prefers to receive only one monitoring report per project per year.

The ➡ used throughout this document indicates text which should typically be included in the mitigation plan.

<u>Definitions</u>

These definitions are for use with this document. Somewhat different definitions may exist in other documents.

> <u>Mitigation in relation to S.404</u>: While mitigation includes sequencing from avoidance to minimization to, finally, compensation, it is frequently used instead of "compensation," including in this document.
>
> <u>Compensatory mitigation</u>: Action taken which provides some form of substitute aquatic resource for the impacted aquatic resource. It may include created, restored, enhanced wetlands, streams, mudflats, etc. and preserved wetlands, streams, and/or uplands.

Wetlands creation: The transformation of upland or deepwater habitat to wetland at a site where the upland or deepwater habitat was not created by human activity. Wetlands creation results in a gain in wetland acreage.

Wetlands restoration: returning a former wetland area, which had been filled, drained, or excavated so that it no longer qualifies as a wetland, to wetland conditions. Wetlands restoration results in a gain in wetland acreage.

Wetlands enhancement: restoring degraded FUNCTIONS of an existing wetland. Degradation may result from infestation by invasive species, partial filling that does not create upland, deliberate removal of woody species (natural changes such as flooding and subsequent demise of trees as a result of beaver activity is not degradation), partial draining, etc. Wetlands enhancement does not result in a gain in wetland acreage.

Invasive species: native and non-native species which aggressively move into areas, especially those that are disturbed, and crowd out less aggressive native species.

Exotic species: Species not native to New England, and usually not native to North America.

Wetland scientist: The applicant should work with the Corps Project Manager to determine the appropriate expertise for the "wetland scientist" needed to oversee a particular project.

Data Presentation

The use of charts, tables, and plan overlays to present data for impact and mitigation areas is encouraged. They are often the most concise method of conveying information and make comparison easier. Tables 2 and 3 at the end of this Introduction are examples of useful presentations of data.

Temporal Losses

All projects which do not have advance mitigation will result in temporal losses which occur as a result of the passage of time between the time when wetland functions are lost to the project impact and when they exist to a similar degree in a compensatory wetland. For example, the wildlife functions of forested wetlands may take 30-50 years or more to develop. Applicants should be aware that additional compensation may be required to offset temporal losses. Functions which *may* not lag behind mitigation construction are flood storage and groundwater discharge and/or recharge. While sediment trapping may develop relatively quickly, water quality functions can take many years to develop as they depend upon the chemical and biological characteristics of the wetland soils. The amount of additional

compensation will depend upon the nature of the wetland proposed and the functions intended. Such compensation may include increased area for wetland creation, restoration, or enhancement or it may be solely additional preservation.

In addition, applicants may expect that more than 1:1 acreage replacement may be deemed appropriate BASED ON WETLAND FUNCTIONS and a "safety factor". The baseline addresses the expected reduction in function (wildlife habitat, water quality functions performed by soils, etc.) of created or restored wetlands in comparison with wetlands formed in place. It also includes a safety factor to allow for some degree of failure. It has been our experience that some portion of most mitigation sites fail to establish wetland conditions.

Wetland mitigation is not an exact science; an adaptive management attitude is a necessity. Consider incorporating experimentation such as including experimental plots with different controls and treatments. This approach requires detailed planning, effective implementation of the plan, close monitoring, adjusting to intermediate results, and making additional modifications when needed to reach the long-term goals.

A. GENERAL INFORMATION

1. To avoid confusion, all mitigation proposal materials should be submitted as a single package without extraneous information that is needed for the permit evaluation but is not pertinent to the mitigation itself.

2. Locus maps that show the location of the impact area and the location of mitigation sites – including preservation areas – are critical components of the plan. They should depict the geographic relationship between the impacted site(s) and the proposed mitigation site(s) and include a vicinity map of approximately 1 inch equals 2,000 feet. For sites where the relationship between the impacted site(s) and proposed mitigation site(s) is not clear at USGS quadrangle scale, an additional plan should be provided at an appropriate scale.

Aerial photographs, if available, should be included. There are several on-line sources available. Recent photographs are preferred.

Watershed(s) must be identified using the USGS 8-digit Hydrologic Unit Code(s) for each mitigation site (See Item A.2 on the Checklist). One source of these codes is an EPA website at: http://cfpub.epa.gov/surf/locate/index.cfm.

B. IMPACT AREA(S)

Impact areas include both wetlands and waters. Most of the checklist items are self-explanatory but clarification is provided for stream information, functions and values assessment, and watershed plans.

Wetlands at each impact site should be described using Cowardin, et. al.[1] and hydrogeomorphic[2] classification systems.

If streams will be impacted, information needed includes length of banks to be impacted, nature of banks, normal seasonal flows, gradient, sinuosity, bed load, lengths of riffles and pools, and adjacent landscape.

When performing functions and values assessments, simply stating "wildlife habitat" or "fishery habitat" is inadequate. Additional information needs to be provided. Provide indicator species for the habitat type such as forest-dwelling migratory birds or mole salamanders and/or woodfrogs for a vernal pool. The more specific the information, the more confidence the Corps will have in the evaluation.

Watershed and/or regional plans that describe aquatic resource objectives should be discussed if such plans are available for the impact area(s). If no such plans exist, so state.

C. MITIGATION AREA(S)

1. Background Information

Provide an explanation of sites considered for mitigation activities and the rationale for selection or rejection. Attachments 1 and 2 discuss when use of a potential mitigation site is practicable, whether on-site or off-site mitigation is appropriate, and whether out-of-kind mitigation is appropriate instead of in-kind. In order to replace the impacted functions, in-kind mitigation is generally preferred.

Wherever possible, select sites where wetlands previously existed and/or where nearby wetlands currently exist. Restoration is typically more feasible and sustainable than creation of wetlands.

Also, whenever possible, locate the mitigation site in a setting of comparable landscape position and hydrogeomorphic class as the impact wetland.

Information on the selected site(s)'s existing wildlife usage, soils, vegetation, and surrounding land use are required. **Wildlife usage** must include information on any probable state and federal threatened and endangered species habitat. Subsurface **soil conditions** have a critical role in mitigation design, whether the substrate be sand, loam, silt, clay, and/or bedrock. Therefore, soil profiles should be provided

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[1] Cowardin, et. al. (1979) "Classification of wetlands and deepwater habitats of the United States," Office of Biological Services, FWS/OBS-79/31, December 1979.

[2] Brinson, M. M. (1993). "A hydrogeomorphic classification for wetlands," Technical Report WRP-DE-4 <http://www.wes.army.mil/el/wetlands/pdfs/wrpde4.pdf>, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. NTIS No. AD A270 053.

that extend down to two feet below the proposed new soil surface. Since much of New England has been and continues to be heavily industrialized, there is a potential for industrial contaminants in the soil. Although contamination does not necessarily preclude the use of a site, testing that is commensurate with the risk may be needed. Describe the existing **vegetation** on the site including a list of species, dominant species, density, community types, and community structure. **Surrounding land use** should be described within at least 500 feet of the site(s) and include a discussion of likely future land uses. Include a discussion of how the site(s) plans fit into the watershed context and the proximity of the site to public and private protected lands.

2. Mitigation Proposed

Similar information is required for the mitigation area(s) as for the impacted area(s).A mitigation site may not be able to provide the full range of functions desired because some functions are incompatible. For example, some wildlife habitat may not be compatible with flood storage.

Typically, detention/retention basins are not acceptable for use as compensatory mitigation. However, they can serve to minimize the adverse effects of a project on nearby wetlands and waters, provided that the stormwater management system will be maintained for the life of the project.

Note that Regulatory Guidance Letter 02-2 states that stream functions lost must also be mitigated. In general this should be on a 1:1 linear foot of bank basis unless a functional assessment methodology indicates that another basis for mitigation is appropriate.

Frequently mitigation designs are constrained by the project itself, landscape features, or public issues that control or otherwise influence the design and/or monitoring and remediation of the mitigation area. Such constraints need to be explained in detail. If there are no constraints (rare), the plan should so state.

To ensure that someone with expertise in wetland science provides construction oversight for the mitigation project, the following language should be included in the narrative portion of the mitigation plan:

➡ A wetland scientist shall be on-site to monitor construction of the wetland mitigation area(s) to ensure compliance with the mitigation plan.

Construction timing of the mitigation and the proposed wetland impacts affects temporal impacts. Therefore, the following language should be included in the narrative portion of the mitigation plan:

➡ Compensatory mitigation shall be initiated not later than 90 days after project initiation and completed not later than one year after the permitted

wetland impacts occur unless the Corps-approved mitigation plan specifically states otherwise and compensation for the temporal impacts are appropriate.

If the impact will occur before the mitigation is constructed, the mitigation plan will address temporal losses and the permittee will work with the Corps to develop financial assurances for the mitigation completion and monitoring, including remedial actions.

All parties responsible for planning, accomplishing, and maintaining the mitigation project are identified.

In accordance with national guidance, financial assurances will be required when the Corps determines it is appropriate to ensure successful implementation of the mitigation[3]. The text to use when such assurances are required is:

→ The permittee shall post a bond for $_____ for construction of the wetland mitigation, monitoring, and potential remedial action as determined by the Corps of Engineers. The bond shall be in the form of a firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. The bond must be in place at all times the construction is underway and during the entire monitoring period, including any extensions required by the Corps of Engineers to ensure permit compliance.

Upon completion of construction, the bond shall be reduced to an amount that will cover the costs of monitoring and possible remedial actions.

Treasury Department Circular 570 is published in the Federal Register, or may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 401 14th Street, NW, 2nd Floor, West Wing, Washington, DC 20227.

Wildlife can pose serious threats to aircraft and therefore mitigation sites near airports are of concern to the Federal Aviation Administration. See Federal Aviation Administration Advisory Circular AC No: 150/5200-33, 5/1/97, http://www1.faa.gov/arp/pdf/5200-33.pdf.

[3] State Departments of Transportation are excluded from this type of financial assurance requirement.

D. HYDROLOGY

Avoid use of water-control structures which must be maintained in perpetuity.

1. The expected seasonal depth, duration, and timing of both inundation and saturation should be described for each of the proposed habitat zones in the mitigation area (particularly related to root zone of the proposed plantings). If shallow monitoring wells are used to develop this rationale, the observations should be correlated to local soil morphologies, rooting depths, water marks or other local evidence of flooding, ponding or saturation, and reflect rainfall conditions during monitoring.

Monitoring Wells

Note that monitoring wells may not be necessary if other data are adequate. Please discuss this issue with Corps staff prior to installation.

Many mitigation plans include monitoring well data. Note that there is an important difference between monitoring wells and piezometers, both of which provide useful information. Details on the uses for and installation of both of these types of wells are available in a document prepared by the Engineers Research and Development Center's Environmental Lab, previously known as the Waterways Experiment Station, entitled, "Installing Monitoring Wells/Piezometers in Wetlands", ERDC TN-WRAP-00-02. It can be found at: http://www.wes.army.mil/el/wrap/pdf/tnwrap00-2.pdf.

If monitoring wells are used and the site is adjacent to a wetland system, installation of at least one well in the adjacent system may provide useful information on the relationship of the water table in the wetland to the one in the proposed mitigation site.

2. Plan indicates if the water source is groundwater, surface runoff, precipitation, lake overflow, and/or stream overflow. Provide substantiation (e.g., well data, adjacent wetland conditions, stream gauge data, precipitation data). Precipitation data is available on the Internet. One site is http://www.erh.noaa.gov under the appropriate Eastern Region Weather Forecast Office.

If stormwater from the project is part of the water budget, information should be provided if that water contribution will not be immediately available. For example, in a highway project, if the mitigation grading will be completed before the highway but the portion of the runoff intended to flow to the mitigation will not be directed to the site immediately, this should be explained. This does not imply that a detention basin will be considered compensatory mitigation.

3. If vernal pool creation is included as part of the mitigation plan, provide evidence that adequate hydrology will be provided to support the target obligate vernal pool species (mole salamanders, woodfrogs, and/or fairy shrimp).

E. GRADING PLANS

1. Plan provides existing and proposed grading plans for mitigation area. Existing contours should be to at least 2' intervals. Proposed contours should be to 1' intervals in the wetlands portion of the mitigation with spot elevations for intermediate elevations. All other areas should be shown at 2' contour intervals.

Where microtopographic variation is planned, the proposed maximum differences in elevation should be specified. The plan does not need to show the locations of each pit and mound as long as a typical cross-section and approximate number of pits and mounds is given for each zone.

Plans should be on 8 ½ x 11" sheets. Large size sheets are encouraged for clarity, but only as a supplement to the letter-sized sheets.

Soil compaction by heavy machinery may adversely affect plantings and/or may result in perching of water. Therefore, efforts should be made to minimize soil compaction area during grading of the mitigation site. If use of heavy machinery cannot by avoided, compaction must be addressed by disking or some other treatment to loosen the soil surface. Similar consideration should be given while spreading the topsoil.

2. Plan provides representative cross sections showing the existing and proposed grading plan, expected range of shallow groundwater table elevations or surface water level consistently expected. Cross-sections should include key features such as upland islands and pools. They should extend beyond the mitigation site into adjacent wetlands and uplands.

The drawings should show the access for maintenance and monitoring.

F. TOPSOIL

Manmade topsoil shall consist of a mixture of equal volumes of organic and mineral materials. Well-decomposed clean leaf compost is the preferred soil amendment to achieve these standards. Note the "clean" refers both to the lack of physical contaminants such as plastic and to the lack of chemical contaminants. If other soil amendments are more readily available than clean leaf compost they can be used to meet the requirement for the appropriate percent organic carbon content (see Item F.3). Note, however, that compost or other organic matter should be clean and free of weed seeds, specifically the seeds of the species listed in Table 4.

It is important to keep in mind the difference between organic *matter* and organic *carbon* both for meeting regulatory guidelines and when classifying the surface horizons in soils as histic (organic soils), mucky modified or mineral. The organic *carbon* content of most upland topsoil is between 1 and 6 percent of dry weight. Soils with more than 20 to 30 percent organic *matter* (12 to 17 percent organic *carbon* content)are known as organic soils or Histosols. The Field Indicators for Identifying Hydric Soils in New England (New England Hydric Soils Technical Committee, 1998, 2nd ed.) glossary defines the criteria for these classifications based on their organic *carbon* contents. 4-12% minimum organic *carbon* content (9 to 21 percent organic *matter*) on a dry weight basis for soils should be used in wetland replication areas. The rule of thumb for conversion is to divide organic *matte*r by 1.72 to get organic *carbon* content and multiply organic *carbon* by 1.72 to get organic *matter* content[4]:

$$O_m/1.72 = O_c \quad \text{and} \quad O_c \times 1.72 = O_m$$

Scrub-shrub and forested wetlands should have about 12% organic carbon; emergent wetlands in permanently or semipermanently inundated areas may only need 4-6%.

Note that the term "loam" that is frequently used for the material spread on a mitigation site after subsoil grading is a landscaping term. In soil science, the term refers to a specific texture of soil comprised of specific amounts of sand, silt, and clay particles. The landscaping term is not a scientific term and should be avoided.

When topsoil must be stockpiled on site, the plan should include plans for maintaining moisture in the soil. The following measures are suggested for the contractor doing the work:

- Seek approval for location of stockpiled materials (from owner/engineer);
- Avoid stockpiling compost organics in piles over 4 feet in height;
- Protect stockpiles from surface water flow and contain them with haybales and/or siltfence;
- Cover stockpiles with a material that prevents erosion (tarps, erosion control mat, straw and temporary seed, depending on size and duration of storage)
- Inspect and repair protection measures listed above regularly (weekly), as well as prior to (to the extent possible) and after storm events.
- Maintain moisture in the soils during droughty periods.

1. Topsoil for mitigation sites can be a source of invasive species seeds. Provide information on the source and the likelihood that such seeds are in it.

[4] Excerpted from Allen, Art, "Organic Matters", *AMWS Newsletter*, December 2001.

2. Twelve or more inches of natural or manmade topsoil should be used in most wetland mitigation areas. Exceptions might be permanently or semi-permanently inundated or saturated areas and turtle nesting areas. Rationale for less than 12 inches should be provided.

3. Natural topsoil proposed to be used for the creation/restoration/ enhancement of wetlands consists of at least 4-12% **with the percentage specified**, organic carbon content (by weight) (or 9-21% organic matter content). Manmade topsoil used for the creation/restoration/ enhancement of wetlands consists of a mixture of equal volumes of organic and mineral materials. This may be accomplished by adding a specific depth of organic material and disking it in to twice that depth.

G. PLANTING PLAN

Planting and/or seeding are generally appropriate for a mitigation site, as determined through consultation with the Corps. When planting is proposed as part of the plan, the guidelines noted below should be followed.

Irrigation

Note that irrigation is solely to enhance the success of vegetation establishment, not to provide hydrology. The use of irrigation for woody plantings should be considered for the first one to two growing seasons after planting due to the unpredictability of short-term local hydrologic conditions and the need for additional care to establish new plantings. Equipment (e.g., pipes, pumps, sprinklers) must be removed and irrigation discontinued no later than the end of the second growing season unless the Corps concurs with extended irrigation. In this situation, the monitoring period shall be extended an equivalent time period.

Two methodologies have been used successfully: water trucks and installation of irrigation systems. The former is limited by accessibility for the truck(s), a likely problem on large sites. The latter tends to be less expensive and may be more effective for large projects.

Use of Mulch

The use of mulch around woody plantings is strongly encouraged, and may be required, to reduce the need for irrigation and to keep down herbaceous vegetation in the immediate vicinity of each plant for a couple of years. There are at least two methods available: biodegradable plastic (which should be stapled to the ground) or organic mulch. Note that organic mulch should not be considered part of the organic content of the topsoil. Suggested specifications for organic mulching are as follows:

> Mulch balled and burlaped or container-grown trees and shrubs in a 3' diameter circle approximately 2" deep.

Mulch bare-root woody planting in an 18" diameter circle approximately 2" deep.

1. The use of scientific names ensures that all involved have the correct understanding of the species of plants proposed to be planted or seeded.

2. Native planting stock from the immediate vicinity of the project is ideal. Whenever possible, plants should be salvaged from wetlands and uplands cleared by the project. In some circumstances, local "scavenging" of wetlands may be acceptable, but care is necessary to avoid jeopardizing established natural habitats or to unintentionally transplant invasive species. Be aware that state or local permits may be required to “scavenge” natural wetlands for planting stock.

No cultivars shall be used.

3. The Cowardin (1979) classification system is typically used to identify the plant communities proposed. If another system is used, an explanation of terms may be needed.

4. A plan view drawing should show where the various species are proposed to be planted. Since showing each individual plant is neither practical nor realistic, this may be illustrated with areas of uniform species composition and the number of plants or rate of seeding within the polygon. The scale should be in the range of 1”=20’ to 1”=100’, depending on the size of the site.

5. Although the prevailing hydrology will ultimately influence the type of wetland that will develop, plantings “jump start” the project. Some species tend to volunteer promptly whereas others may take years to move into a site; consideration should be given to emphasize planting species unlikely to “volunteer”.

6. Woody stock should be proposed to be planted in densities not less than 600 trees and shrubs per acre, including at least 400 trees per acre in forested cover types.

Woody planting densities may require adjustment depending upon the goals of the mitigation plan and the ‘reference wetland’ used to develop the habitat goals. For example, if the primary goal for a particular creation site is flood storage and there is minimal need for wildlife habitat but there is interest in developing a woody component in the flood storage area, the density may be reduced. Also, if the wetland type desired is a dense thicket, the density may need to be increased.

7. Where uniform coverage is anticipated, herbaceous stock is proposed to be planted in densities not less than the equivalent of 3 feet on center for species which spread with underground roots; 2 feet on center for species which form clumps.

8. The list of species proposed in seed mixes should not include any species in the list of invasives in Table 4.

Although the use of non-native species is typically discouraged, there are situations where such use may be appropriate such as using *Secale cereale* (Annual Rye) to quickly stabilize a site. The species should be noted and the reason for their use explained.

Similarly, non-native genotypes and cultivars should not be used.

Species listed in Table 4 are not to be included as seed or planting stock in the overall project.[5] Most of these species do not need to be actively removed from the site. Exceptions are included in the Monitoring section (Section M). More may be added by the Corps on a case-by-case basis.

9. Cross-sectional drawings should include identification of vegetative community (e.g., forested, shrub swamp, etc.) zones. This can be combined with the plans required for grading if they are not too complex.

10. During the first few years, while the designed wetland vegetative zones become established, they are susceptible to colonization and subsequent domination by invasive species. A number of plants are known to be especially troublesome in this regard. The following stipulation shall be included in the mitigation plan, either in the plan view or in the narrative portion of the plan:

➡ To reduce the immediate threat and minimize the long-term potential of degradation, the species included on the invasive plant species list in Table 4 of the New England District Mitigation Plan Guidance shall not be included as planting stock in the overall project. Only plant materials native and indigenous to the region shall be used (with the exception of **[specify]**). Species not specified in the mitigation plan shall not be used without prior written approval from the Corps.

11. The following stipulation shall be included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

➡ During planting, a qualified wetland professional may relocate up to 50 percent of the plants in each community type if as-built site conditions would pose an unreasonable threat to the survival of plantings installed according to the mitigation plan. The plantings shall be relocated to locations with suitable hydrology and soils and where appropriate structural context with other plantings can be maintained.

[5] This list is a compilation of state lists from New England and additional species recommended by regional botanical experts.

H. COARSE WOODY DEBRIS AND OTHER FEATURES

Coarse woody debris includes such materials as logs, stumps, smaller branches, and standing snags. Placement of this material is generally inappropriate in tidal or frequently flooded environments. As much as possible, these materials will be in various stages of decomposition and salvaged from natural areas cleared for the other elements of the project. The following language is included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

➡ A supply of dead and dying woody debris shall cover at least 4% of the ground throughout the mitigation sites after the completion of construction of the mitigation sites. These materials should not include species shown on the list of invasive species (Table 4) in the New England District Mitigation Plan Guidance.

When mitigation requires a component of forest or scrub-shrub habitat, the design should include plans for a continuum of coarse woody debris.

When a tree dies, it may continue to provide habitat for another century or longer. The speed of the recycling processes depends on many factors, but the main point is that coarse woody materials are relatively durable and remain as important ecological features both below- and above-ground for a long time. Long after the last needles or leaves fall to the forest floor, a tree persists, parceling itself out in bits and pieces.

In the first years, if a tree remains upright, the greatest volume of its litter may consist of bark, twigs, and small branches. Later, as insects and fungus weaken the aerial framework, larger limbs and sections of the trunk tumble to the ground where decay occurs under quite different conditions. On the forest floor, well-decomposed logs may sustain greater faunal richness. In an ideal situation, there is an uninterrupted supply of woody litter in various sizes and stages of decay providing a diverse range of habitats. Decomposition is one of the natural successions in a forest. If one link of the chain is lacking, the process falters. Wetland builders should factor coarse woody debris into most habitat mitigation strategies.

Frequently the inclusion of scattered various sized boulders, as well as woody debris is an appropriate method of increasing structure and habitat in a site. Note of caution: if not properly screened by a wetland scientist, such debris can be a source of invasive species.

I. EROSION CONTROLS

The following language is included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

- Temporary devices and structures to control erosion and sedimentation in and around mitigation sites shall be properly maintained at all times. The devices and structures shall be disassembled and properly disposed of no later than November 1 three full growing seasons after planting. Sediment collected by these devices will be removed and placed upland in a manner that prevents its erosion and transport to a waterway or wetland.

Cordoning off of an entire site with erosion controls is discouraged as it impedes animal movement. If circling of an entire site is needed, either gaps or overlaps with intervening space should be provided.

J. INVASIVE AND NOXIOUS SPECIES

Projects should avoid introducing or increasing the risk of invasion by unwanted plants (such as those listed in J.3. below) or animals (such as zebra mussels). Soils disturbed by projects are very susceptible to invasion by undesirable species. Be particularly alert to the risk of invasion on exposed mineral soils. Exposed mineral soils may result from excavation or filling. Noxious species often get a foothold along project drainage features where the dynamics of erosion and accretion prevail. Along saltmarshes, be especially alert to the project's influence on freshwater runoff. Frequently, *Phragmites australis* invasion is an unanticipated consequence of freshwater intrusion into the saltmarsh.

1. The discussion of risk includes an assessment of the potential for invasion of the wetland by the species listed in J.3 or other problematic species.

2. The plan should identify regulatory and ecological constraints that influence the design of any plan to control invasive plants and animals by biological, mechanical, or chemical measures. For example, if a state requires a permit for use of herbicide, this may constrain attempts to control an invasive plant species. If there are no constraints, so state.

3. The plan should describe the strategy to control, or recognize and respond to, the invasion of the mitigation site by Common reed (*Phragmites australis*), Purple loosestrife (*Lythrum salicaria*), Buckthorns (*Rhamnus* spp.), Olives (*Elaeagnus* spp.), Multiflora rose (*Rosa multiflora*), Reed canary-grass (*Phalaris arundinacea*), Japanese knotweed (*Polygonum cuspidatum*), and any other species identified as a problem at the site. Controls include mechanical (pulling, mowing, or excavating on-site), chemical (herbiciding), and biological (planting fast-growing trees and shrubs for shading or releasing herbivorous insects).

K. OFF-ROAD VEHICLE USE

If there is a potential for off-road vehicle access at the site, which may include snowmobile usage, the mitigation plan shall include a strategy to minimize impacts.

Plans should illustrate locations of any necessary barriers placed at access points to the mitigation sites to prevent vehicles from damaging the sites.

L. PRESERVATION

1. Adequate buffers are proposed to protect the ecological integrity of creation, restoration, and/or enhancement areas.

In most cases, a protected (preserved) buffer will be required around creation, restoration, and enhancement sites, including stream mitigation as this is of benefit on a local and watershed scale throughout New England. The extent of the buffer will depend upon the landscape position of the site(s) and current and potential surrounding land uses. Usually buffers will consist of uplands but wetlands also may serve that function.

2. Wetlands within subdivisions, golf courses, etc. should generally be protected along with appropriate buffers. This is part of the avoidance and minimization steps of mitigation.

3. Preservation should be part of every mitigation package as preservation of a creation, restoration, or enhancement area, and buffer; the remaining unimpacted wetlands on-site as part of avoidance and minimization; or as a stand-alone form of mitigation. Ideally the preservation document would be prepared, reviewed, and approved by the Corps prior to submission of the final mitigation plan and permit issuance. If this is not possible, the following language should be included in the plan[6]:

➔ Compensatory mitigation sites and on-site unimpacted wetlands (and buffers) to be set aside for conservation shall be protected in perpetuity from future development. Within 90 days of the date this permit is issued, the permittee shall submit to the Corps of Engineers a draft of the conservation easement or deed restriction. Within 30 days of the date the Corps approves this draft document in writing, the permittee shall execute and record it with the Registry of Deeds for the Town of _____ and the State of _____. A copy of the executed and recorded document must then be sent to the Corps of Engineers within 90 days of the date it was recorded. The conservation easement or deed restriction shall enable the site or sites to be protected in perpetuity from any future development. For preservation as part of compensation, the conservation easement or deed restriction shall expressly allow for the creation, restoration, remediation and monitoring activities required by this permit on the site or sites. It shall prohibit all other filling, clearing and other disturbances (including vehicle access) on these sites except

[6] Departments of Transportation, in particular, may need to have the timing requirements modified. This will be addressed on a case-by-case basis.

for activities explicitly authorized by the Corps of Engineers in these approved documents.

If it is possible to have the document prepared and approved prior to final mitigation plan submission and permit issuance, only the following needs to be included:

→ Within 30 days of the date of permit issuance, the permittee shall execute and record the preservation document with the Registry of Deeds for the Town of - _____ and the State of _____. A copy of the executed and recorded document must then be sent to the Corps of Engineers within 90 days of the date it was recorded.

4. Plans showing the location of all sites to be preserved are required. In addition to a locus, they must be sufficiently detailed to determine relationships to adjacent development and/or properties. In some cases it may be appropriate to have signs at the boundaries of the preservation area(s). The sign design should be noted in the documentation.

5. There are numerous forms of preservation documents. They include fee transfer to another entity such as a non-profit organization or public agency, easement given to a non-profit organization or public agency, deed restriction, or restrictive covenant. The form should be specified or a copy of the document(s) included.

M. MONITORING PLAN

Once the final mitigation plan is incorporated into the permit, the permit will require full implementation of the mitigation plan, including remedial measures during the first five or more growing seasons to ensure success. Typically, sites proposed to be emergent-only wetlands will be monitored for five years and sites proposed to be scrub-shrub and/or forested wetlands will be monitored for five to ten years, as extended periods for monitoring may be appropriate in some cases. Unsuccessful mitigation does not, in and of itself, constitute permit non-compliance; however, failure to implement the plan and remedial measures does.

The following language should be included in the narrative portion of the mitigation plan:

→ **MONITORING**

Monitoring Plan Guidance

If mitigation construction is initiated in, or continues throughout the year, but is not completed by December 31 of any given year, the permittee will provide the Corps, Policy Analysis and Technical Support Branch, a letter providing the date mitigation work began and the work completed as of December 31. The letter

should be sent no later than January 31 of the next year. The letter must include the Corps permit number.

For each of the first **[specify]** full growing seasons following construction of the mitigation site(s), the site(s) shall be monitored. Observations will occur at least two times during the growing season – in late spring/early summer and again in late summer/early fall. Each annual monitoring report shall be submitted to the Corps, Regulatory Division, Policy Analysis and Technical Support Branch, no later than December 15 of the year being monitored. Failure to perform the monitoring and submit monitoring reports constitutes permit non-compliance. Each report coversheet shall indicate the permit number and the report number (Monitoring Report 1 of 5, for example). The reports shall answer the following success-standard questions and shall address in narrative format the items listed after the questions. The reports shall also include the monitoring-report appendices listed below. The first year of monitoring shall be the first year that the site has been through a full growing season after completion of construction and planting. For these special conditions, a growing season starts no later than May 31. However, if there are problems that need to be addressed and if the measures to correct them require prior approval from the Corps, the permittee shall contact the Corps by phone (1-800-362-4367 in MA or 1-800-343-4789 in ME, VT, NH, CT, RI) or letter as soon as the need for corrective action is discovered.

Remedial measures shall be implemented - at least two years prior to the completion of the monitoring period - to attain the success standards described below within **[specify]** growing seasons after completion of construction of the mitigation site(s). Should measures be required within two years of the end of the monitoring period, the monitoring period will be extended to ensure two years of monitoring after the remedial work is completed. Measures requiring earth movement or changes in hydrology shall not be implemented without written approval from the Corps.

At least one reference site adjacent to or near each mitigation site is described and shown on a locus map.

Success Standards

1) Does the site have at least 500 trees and shrubs per acre, of which at least 350 per acre are trees for proposed forested cover types, that are healthy and vigorous and are at least 18" tall in 75% of each planned woody zone AND at least the following number of non-exotic species including planted and volunteer species? Volunteer species should support functions consistent with the design goals. To count a species, it should be well represented on the site (e.g., at least 50 individuals of that species per acre).

# species planted	minimum # species required (volunteer and planted)
2	2
3	3
4	3
5	4
6	4
7	5
8	5
9 or more	6

Vegetative zones consist of areas proposed for various types of wetlands (shrub swamp, forested swamp, etc.). The performance standards for density can be assessed using either total inventory or quadrat sampling methods, depending upon the size and complexity of the site.

2) Does each mitigation site have at least 80% areal cover, excluding planned open water areas or planned bare soil areas (such as for turtle nesting), by noninvasive species (See Table 4)? Do planned emergent areas on each mitigation site have at least 80% cover by noninvasive hydrophytes? Do planned scrub-shrub and forested cover types have at least 60% cover by noninvasive hydrophytes, of which at least 15% are woody species? For the purpose of this success standard, invasive species of hydrophytes are:

Cattails -- *Typha latifolia, Typha angustifolia, Typha glauca*;
Common Reed -- *Phragmites australis*;
Purple Loosestrife -- *Lythrum salicaria*;
Reed Canary Grass -- *Phalaris arundinacea*; and
Buckthorn – *Rhamnus frangula*.

3) Are Common reed (*Phragmites australis*), Purple loosestrife *(Lythrum salicaria*), Russian and Autumn olive (*Elaeagnus* spp.), Buckthorn (*Rhamnus* spp.), Japanese knotweed (*Polygonum cuspidatum*), and/or Multiflora rose (*Rosa multiflora*) plants at the mitigation site(s) being controlled?

4) Are all slopes, soils, substrates, and constructed features within and adjacent to the mitigation site(s) stabilized?

Monitoring Report Narrative Requirements

Items for narrative discussion:

- Highlighted summary of problems which need immediate attention (e.g., problem with hydrology, severe invasives problem, serious erosion, major losses from herbivory, etc.). This should be at the beginning of the report.

- Dates work on each mitigation site began and ended.

- Describe the monitoring inspections that occurred since the last report.

- Soils data, commensurate with the requirements of the soils portion of the 1987 Corps Delineation Manual (Technical Report Y-87-1) New England District data form, should be collected after construction and every alternate year throughout the monitoring period. If monitoring wells or gauges were installed as part of the project, this hydrology data should be submitted annually.

- Concisely describe remedial actions done during the monitoring year to meet the four success standards – actions such as removing debris, replanting, controlling invasive plant species (with biological, herbicidal, or mechanical methods), regrading the site, applying additional topsoil or soil amendments, adjusting site hydrology, etc. Also describe any other remedial actions done at each site.

- Report the status of all erosion control measures on the compensation site(s). Are they in place and functioning? If temporary measures are no longer needed, have they been removed?

- Give visual estimates of (1) percent vegetative cover for each mitigation site and (2) percent cover of the invasive species listed under Success Standard No. 2, above, in each mitigation site.

- What fish and wildlife use the site(s) and what do they use it for (nesting, feeding, shelter, etc.)?

- By species planted, describe the general health and vigor of the surviving plants, the prognosis for their future survival and a diagnosis of the cause(s) of morbidity or mortality.

- What remedial measures are recommended to achieve or maintain achievement of the four success standards and otherwise improve the extent to which the mitigation site(s) replace the functions and values lost because of project impacts?

IF MITIGATION INCLUDES VERNAL POOL CREATION):

Does the vernal pool creation take into account the critical need for unobstructed access to and from the pool, as well as an adequate extent of upland habitat to ensure success?

Pool(s) are monitored for obligate and facultative vernal pool species weekly for four weeks from the beginning of the vernal pool activity in the spring (will vary throughout New England) and then biweekly until the end of July for the entire monitoring period. The period of monitoring is specified. Data identify frog species, salamander genera, and the presence/absence of fairy shrimp. Macroinvertebrates can be identified to the order.

In addition, photographs of the pool(s) taken monthly during the pool monitoring period (March/April-July) from a set location(s) will be included. Photographs will include panoramas of surrounding habitat.

Other data required: pH and temperature of water at beginning and end of each monitoring cycle; pool depth at deepest point(s) (or state if >3') to nearest inch or centimeter; substrate of pool(s) (dead leaves, herbaceous vegetation, bare soil—organic or mineral, etc.); plant species noted in and around the perimeter of the pool(s).

If the state has a vernal pool register or certification program, the pool(s) is registered and/or certified prior to the final monitoring report submission.

Monitoring Report Appendices

Appendix A -- A copy of this permit's mitigation special conditions and summary of the mitigation goals.

Appendix B -- An as-built plan showing topography to 1-foot contours, any inlet/outlet structures and the location and extent of the designed plant community types (e.g., shrub swamp). Within each community type the plan shall show the species planted—but it is not necessary to illustrate the precise location of each individual plant. This is should be included in the first monitoring report unless there are grading modifications or additional plantings of different species in subsequent years.

Appendix C – A vegetative species list of volunteer species in each plant community type. The volunteer species list should, at a minimum, include those that cover at least 5% of their vegetative layer.

Appendix D -- Representative photos of each mitigation site taken from the same locations for each monitoring event.

N. ASSESSMENT PLAN

The following language should be included in the narrative portion of the mitigation plan:

ASSESSMENT

A post-construction assessment of the condition of the mitigation site(s) shall be performed following the fifth growing season after completion of the mitigation site(s) construction, or by the end of the monitoring period, whichever is later. "Growing season" in this context begins no later than May 31st. To ensure objectivity, the person(s) who prepared the annual monitoring reports shall not perform this assessment without written approval from the Corps. The assessment report shall be submitted to the Corps by December 15 of the year the assessment is conducted ; this will coincide with the year of the final monitoring report, so it is acceptable to include both the final monitoring report and assessment in the same document.

The post-construction assessment shall include the four assessment appendices listed below and shall:

- Summarize the original or modified mitigation goals and discuss the level of attainment of these goals at each mitigation site (include vernal pool creation if that is a component of the mitigation).

- Describe significant problems and solutions during construction and maintenance (monitoring) of the mitigation site(s).

- Identify agency procedures or policies that encumbered implementation of the mitigation plan. Specifically note procedures or policies that contributed to less success or less effectiveness than anticipated in the mitigation plan.

- Recommend measures to improve the efficiency, reduce the cost, or improve the effectiveness of similar projects in the future.

ASSESSMENT APPENDICES:

Appendix A -- Summary of the results of a functions and values assessment of the mitigation site(s), using the same methodology used to determine the functions and values of the impacted wetlands.

Appendix B -- Calculation of the area of wetlands in each mitigation site using the 1987 Corps Wetlands Delineation Manual. Supporting documents shall include (1) a scaled drawing showing the wetland boundaries and representative transects and (2) datasheets for corresponding data points along each transect.

Appendix C -- Comparison of the area and extent of delineated constructed wetlands (from Appendix B) with the area and extent of created wetlands proposed in the mitigation plan. This comparison shall be made on a scaled

drawing or as an overlay on the as-built plan. This plan shall also show the major vegetation community types.

Appendix D -- Photos of each mitigation site taken from the same locations as the monitoring photos, including photos of vernal pools, if applicable.

O. CONTINGENCY

Describe the procedures to be followed should unforeseen site conditions or circumstances prevent the site from developing as intended. Examples of such situations include unanticipated beaver activity, disruption of the groundwater by blasting or other construction in the vicinity, unearthing an unexpected archaeological site, and encountering hazardous waste.

P. OTHER COMMENTS

REFERENCES

Ashby, Steven. "Approaches for the Mitigation of Water Quality Functions of Impacted Wetlands – A Review," ERDC TN-WRAP-02-03 http://www.wes.army.mil/el/wrap/pdf/tnwrap02-3.pdf, U.S. Army Research and Development Center, Vicksburg, MS.

Brinson, M. M. (1993). "A hydrogeomorphic classification for wetlands," Technical Report WRP-DE-4. http://www.wes.army.mil/el/wetlands/pdfs/wrpde4.pdf, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. NTIS No. AD A270 053.

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Environmental Laboratory. (1987). "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, <http://www.wes.army.mil/el/wetlands/pdfs/wlman87.pdf>, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

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Streever, W., and Perkins, E. (2000). "Importing plant stock for wetland restoration and creation: Maintaining genetic diversity and integrity," *WRAP Technical Notes Collection* (ERDC TN-WRAP-00-03), U.S. Army Engineer Research and Development Center, Vicksburg, MS. *www.wes.army.mil/el/wrap*

Treasury Department Circular 570.

U.S. Army Corps of Engineers. 2002. Guidance on compensatory mitigation projects for aquatic resource impacts under the Corps Regulatory Program pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. Regulatory Guidance Letter No. 02-2.

Table 1
Cross-reference Between Mitigation Plan and
New England District, U. S. Army Corps of Engineers
Mitigation Plan Checklist (2004).

Check-list Item	Description	Relevant Section	Page Number
A. General Information			
1.	One complete package		
2.a	Locus map	Figure 1	
2.b	Aerial photo	Figure 2	
2.c	Lat/Long	Figure 1	
2.d	HUC	Section A	p.1
B. Impact Area(s)			
1.	Wetland acreage	Section A	p.2, Table 1
2.	Wetland classes	Section A	p.3, Table 1
3.	Streams	Section A	p. 3, Table 1
4.	Wetland and stream functions and values	Section A	p.3, Table 1
5.	Type and purpose of work	Section A	p. 3
6.	Watershed plans	Section A	p. 4
C. Mitigation Area(s)			
1.a	Mitigation alternatives	Section B	
1.b	Existing wildlife use	Section C	p.2
1.c	Existing soil	Section C	p.3
1.d	Existing vegetation	Section C	p. 7
1.e	Surrounding land use	Section C	p.9
1.f	USFWS Clearance Letter	Section C	p.12
1.g	SHPO Clearance Letter	Section C	p. 13
2.a	Wetland acreages at each site	Section D	p. 1, Table 2
2.b	Wetland classes at each site	Section D	p. 2, Table 2
2.c	Functions and values proposed at each site	Section D	p. 2, Table 2
2.d	Stream mitigation	Section D	p.3
2.e	Reference site(s)	Section D	p. 4
2.f	Design Constraints	Section E	p.1
2.g	Construction oversight	Section E	p. 2
2.h	Project construction timing	Section E	p. 3
2.i	Responsible parties	Section E	p. 5
2.j	Financial assurances	Section F	
2.k	FAA Issues	Section E	p.6
D. Hydrology			
1.	Adequate hydrology	Section G	p. 8, Tables 3, 4
1.a	Typical year water budget	Section G	Figure 1

1.b	Wet year water budget	Section G	Figure 2
1.c	Dry year water budget	Section G	Figure 3
2.	Water source(s)	Section G	p. 8
3.	If vernal pool, adequate hydrology	Section G	p. 9, 23
E. Grading Plan			
1.a	Plan View - existing and proposed contours	Appendix A	Figures 2-5
1.b	Plan View – microtopography	Appendix A	Figures 2-5
1.c	Plan View – scale	Appendix A	
1.d	Plan View - legible	Appendix A	
2.	Representative cross-sections	Appendix A	Figures 7-9
3.	Other grading comments (if any)	N/A	
F. Topsoil			
1.	Proposed source	Section H	p. 1
2.	Depth	Section H	p. 5, Figures 7-9
3.	Organic content	Section H	p. 6
G. Planting Plan			
1.	Scientific names	Appendix A	Figures 2-5
2.	Native materials	Section H	p. 8
3.	Community types	Section H	p. 8
4.	Location on plans	Appendix A	Figures 2-5
5.	Plantings for community type	Section H	p. 8
6.	Woody stock density	Appendix A	Figures 2-5
7.	Herbaceous stock density	N/A	
8.	Seed mix composition	Section H	p. 10
9.	Cross-sections	Appendix A	Figures 7-9
10.	No invasive species plantings	Section H	p. 11
11.	Relocation text	Section H	p. 12
12.	Other	N/A	
H. Coarse Woody Debris			
	Is proposed	Appendix A	Figure 2-5
I. Erosion Controls			
	Deadline for removal	Section H	p. 7
J. Invasive and Noxious Species			
1.	Risk	Section I	p.1
2.	Constraints	Section I	p. 1
3.	Control plan	Section I	p. 2
K. Off-Road Vehicle Use			
1.	Usage in vicinity	Section I	p. 4
2.	Control plan	N/A	
L. Preservation			
1.	Adequate buffers	Section J	p. 1
2.	Internal wetlands protected	Section J	Figure 10

3.	Preservation language	Section J	p. 2
4.	Preservation site plans	Section J	Figure 11
5.	Legal instrument(s)	Section J	p. 5
M. Monitoring Plan			
	Appropriate language	Section K	
N. Assessment Plan			
	Appropriate language	Section L	
O. Contingency			
	Plan in place	Section M	
P. Other			

Table 2
Sample Summary of Proposed Wetland Mitigation

MITIGATION SITE	TYPE OF MITIGATION	SIZE
1	Wetland Enhancement (E), Restoration (R), and Creation (C)	E = 15,600 s.f. R = 49,560 s.f. C = 15,900 s.f.
2	Wetland Creation	42,100 s.f.
3	Wetland Preservation (note: sites 1 and 2 to be preserved as well)	13.5 acres
3	Upland Preservation	6.3 acres

Table 3
Sample Wetland Impact Area Function-Value Summary

Wetland Impact Area #	Area (s.f.)	Wetland Type (Cowardin)	WETLAND FUNCTIONS AND VALUES												
			GWR/D	FFA	S&TR	NR&T	PE	S&S	F&SH	WLH	T&E	REC	ED/S	U/H	VQ/A
1	31,350	PFO1/ PSS1B	X	X						P					X
2	14,190	PEM1/ PSS1B	X	P		X			X	X					
3	23,600	PFO1	X							P		X			
4	49,010	PSS1B	X	X		X				P					X
5	2,350	PEM1		X	X	X		P		X					

Table 4
Invasive and other Unacceptable Plant Species[1]

a. Herbs:

Aegopodium podagraria	Goutweed or Bishop's weed
Aira caryophyllea	Silver hairgrass
Alliaria petiolata	Garlic mustard
Allium vineale	Field garlic
Ampelopsis brevipedunculata	Porcelain berry
Anthoxanthum odoratum	Sweet vernal grass
Anthriscus sylvestris	Chervil
Arctium minus	Common burdock
Asparagus officinalis	Asparagus
Barbarea vulgaris	Yellow rocket
Bromus tectorum	Drooping brome-grass
Butomus umbellatus	Flowering rush
Cabomba caroliniana	Fanwort
Callitriche stagnalis	Water-starwort
Calystegia sepium	Japanese bindweed
Cardamine impatiens	Bushy rock-cress
Cardamine pratensis	Cuckoo-flower
Carex kobomugi	Japanese sedge
Centaurea biebersteinii	Spotted knapweed
Chelidonium majus	Celandine
Cirsium arvense	Canada-thistle
Cirsium palustre	Marsh thistle
Commelina communis	Asiatic day-flower
Coronilla varia	Crown vetch
Cyperus esculentus	Yellow nutsedge
Dactylis glomerata	Orchard-grass
Datura stramonium	Jimsonweed
Echinochloa crusgalli	Barnyard grass
Egeria densa	Giant waterweed
Eichhornia crassipes	Water hyacinth
Eleusine indica	Goosegrass
Elsholtzia ciliata	Elsholtzia
Elytrigia repens	Quack-grass
Epilobium hirsutum	Hairy willow-herb
Euphorbia cyparissias	Cypress spurge
Euphorbia esula	Leafy spurge
Festuca filiformia	Hair fescue
Festuca ovina	Sheep fescue

[1] Scientific names are those used in Gleason, Henry and A. Cronquist, 1991, *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*: Second Edition, The New York Botanical Garden: New York.

Froelichia gracilis	Slender snake cotton
Geranium nepalense (G. sibericum)	Nepalese crane's-bill
Geranium thunbergii	Thunberg's geranium
Glaucium flavum	Sea- or horned poppy
Glechoma hederacea	Gill-over-the-ground
Glyceria maxima	Sweet reedgrass
Hemerocallis fulva	Tiger-lily
Heracleum mantegazzianum	Giant hogweed
Hesperis matronalis	Dame's rocket
Hydrilla verticillata	Hydrilla
Hydrocharis morsus-ranae	European frog-bit
Hylotelephium telephium (*Sedum telephium*)	Live-forever or Orpine
Hypericum perforatum	St. John's wort
Impatiens glandulifera	Ornamental jewelweed
Iris pseudacorus	Yellow iris
Kochia scoparia	Summer cypress
Lamium spp. (all)	Dead nettle
Lepidium latifolium	Tall pepperwort
Lotus corniculatus	Birdsfoot trefoil
Lysimachia nummularia	Moneywort
Lysimachia vulgaris	Garden loosestrife
Lythrum salicaria	Purple loosestrife
Malva neglecta	Cheeses or common malva
Marsilea quadrifolia	Water shamrock or Eu. water clover
Mentha arvensis	Field-mint
Microstegium vimineum	Japanese stilt-grass
Miscanthus sinensis	Eulalia
Myosotis scorpioides	True forget-me-not
Myosoton aquaticum	Giant chickweed
Myriophyllum aquaticum	Parrot feather
Myriophyllum heterophyllum	Variable water-milfoil
Myriophyllum spicatum	Eurasian water-milfoil
Najas minor	Lesser naiad
Nymphoides peltata	Yellow floating heart
Ornithogalum umbellatum	Star of Bethlehem
Pastinaca sativa	Wild parsnip
Phalaris arundinacea	Reed canary-grass
Phragmites australis	Reed grass, Phragmites
Poa compressa	Canada bluegrass
Poa pratensis	Kentucky bluegrass
Poa trivialis	Rough bluegrass
Polygonum aubertii	Silver lace-vine
Polygonum cespitosum	Cespitose knotweed
Polygonum cuspidatum	Japanese knotweed
Polygonum perfoliatum	Mile-a-minute vine

Polygonum persicaria	Lady's thumb
Polygonum sachalinense	Giant knotweed
Potamogeton crispus	Curly pondweed
Puccinellia maritima	Seaside alkali-grass
Pueraria montana	Kudzu
Ranunculus ficaria	Lesser celandine
Ranunculus repens	Creeping buttercup
Rorippa microphylla	One-row yellow cress
Rorippa nasturtium-aquaticum	Watercress
Rorippa sylvestris	Creeping yellow cress
Rumex acetosella	Sheep-sorrel
Rumex obtusifolius	Bitter dock
Salvinia molesta	Salvinia
Senecio jacobaea	Tansy ragwort
Setaria pumila (S.lutescens, S. glauca)	Yellow foxtail or y. bristlegrass
Silphium perfoliatum	Cup plant
Solanum dulcamara	Bittersweet nightshade
Stellaria graminea	Common stitchwort
Tanacetum vulgare	Tansy
Thymus pulegioides	Wild thyme
Trapa natans	Water-chestnut
Tussilago farfara	Coltsfoot
Typha latifolia[2]	Common or Broad-leaved cattail
Typha angustifolia[4]	Narrow-leaved cattail
Valeriana officinalis	Garden heliotrope
Verbascum thapsus	Common mullein
Veronica beccabunga	European speedwell
Vincetoxicum rossicum (V. nigrum)	Black swallow-wort
Xanthium strumarium	Common cocklebur

b. Woody Plants:

Acer ginnala	Amur maple
Acer platanoides	Norway maple
Acer pseudoplatanus	Sycamore maple
Actinidia arguta	Kiwi vine
Ailanthus altissima	Tree-of-heaven
Berberis thunbergii	Japanese barberry
Berberis vulgaris	Common barberry
Catalpa speciosa	Western catalpa
Celastrus orbiculatus	Oriental bittersweet

[2] *Typha* spp. are native species which provide good water quality renovation and other functions/values. However, they are aggressive colonizers which, given the opportunity, will preclude establishment of other native species. They are included in this list as species not to be planted, not because they are undesirable in an established wetland, but to provide opportunities for other species to become established. It is likely they will eventually move in without human assistance.

Cynanchum louiseae	Black swallow-wort
Cytisis scoparius	Scotch broom
Elaeagnus angustifolia	Russian olive
Elaeagnus umbellata	Autumn olive
Euonymus alata	Winged euonymus
Euonymus fortunei	Climbing euonymus
Humulus japonicus	Japanese hops
Hypericum prolificum	Shrubby St. John's Wort
Ligustrum obtusifolium	Japanese privet
Ligustrum vulgare	Common/hedge privet
Lonicera japonica	Japanese honeysuckle
Lonicera maackii	Amur honeysuckle
Lonicera morrowii	Morrow's honeysuckle
Lonicera tartarica	Tatarian honeysuckle
Lonicera x bella	Morrow's X Tatarian honeysuckle
Lonicera xylosteum	European fly-honeysuckle
Morus alba	White mulberry
Paulownia tomentosa	Princess tree or empress tree
Phellodendron japonicum	Corktree
Populus alba	Silver poplar
Rhamnus cathartica	Common buckthorn
Rhamnus frangula	European buckthorn
Ribes sativum	Garden red currant
Robinia pseudoacacia	Black locust
Rosa multiflora	Multiflora rose
Rosa rugosa	Rugosa rose
Rubus phoenicolasius	Wineberry
Salix purpurea[3]	Basket or purple-osier willow
Sorbus aucuparia	European mountain-ash
Taxus cuspidata	Japanese yew
Ulmus pumila	Siberian elm
Wisteria floribunda	Wisteria

[3] This is not appropriate for use in wetland mitigation. In some circumstances it may be appropriate in stream bank stabilization.